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ABSTRACT

Since 1985, Congress has provided the U.S. Department of Education with funds for a program to improve the availability and quality of math and science teachers at the elementary and secondary level. This effort was initiated in response to concern that the math and science skills of elementary and secondary school students were insufficient to meet the demands of the work place and to keep the Nation competitive in the international economy. In 1988, the Congress repealed the original authority for the program and authorized a somewhat modified version as the Dwight D. Eisenhower Mathematics and Science Education Act. The Eisenhower program is focused more fully on math and science education than the original. Evaluation data on the original version of the math and science program indicates that funds appear to have been spent largely on inservice training for current math and science teachers, not on activities to retrain personnel or attract new math and science teachers. Some localities used the funds to help meet new state requirements affecting math and science instruction. This report provides an overview of the Dwight D. Eisenhower Mathematics and Science Education Act, administered by the U.S. Department of Education. It analyzes program provisions, funding history, and program evaluations. (Author/CW)

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CRS Report for Congress

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Dwight D. Eisenhower Mathematics and Science Education Act: An Analysis of Recent Legislative Action and Program Evaluations

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DWIGHT D. EISENHOWER MATHEMATICS AND SCIENCE EDUCATION ACT: AN ANALYSIS OF RECENT LEGISLATIVE ACTION AND PROGRAM EVALUATIONS

SUMMARY

Since FY 1985, the Congress has provided the U.S. Department of Education with funds for a program to improve the availability and quality of math and science teachers at the elementary and secondary level. This effort was initiated in response to concern that the math and science skills of elementary and secondary school students were insufficient to meet the demands of the work place and to keep the Nation competitive in the international economy. Many observers asserted that the country suffered from a shortage of math and science teachers.

In 1988, the Congress repealed the original authority for the program and authorized a somewhat modified version as the Dwight D. Eisenhower Mathematics and Science Education Act. The Eisenhower program is focused more fully on math and science education than the original. Recent funding trends suggest that the Congress is increasingly committed to this effort, having raised the annual appropriation from its lowest point of slightly more than $43 million in FY 1986 to an FY 1989 level of over $137 million.

Evaluation data on the original version of the math and science program are limited. Nevertheless, funds appear to have been spent largely on inservice training for current math and science teachers, not on activities to retrain personnel or attract new math and science teachers. Some localities used the funds to help meet new State requirements affecting math and science instruction. A national evaluation of many aspects of the program is being funded by the U.S. Department of Education, with a reporting date in 1991.

CONTENTS

INTRODUCTION..... 1

MAJOR COMPONENTS OF THE EISENHOWER MATHEMATICS AND SCIENCE EDUCATION PROGRAM..... 4
- Purpose..... 4
- Authorization of Appropriations..... 5
- Interstate Allocation of Funds..... 5
- Intrastate Allocation of Funds..... 6
- Elementary and Secondary Education Programs..... 7
- Higher Education Programs..... 9
- State and Local Applications..... 10
- National Programs..... 11
- Federal Requirements..... 11
- Private School Students and Teachers..... 12

FUNDING TRENDS..... 12

PROGRAM EVALUATIONS..... 14

DWIGHT D. EISENHOWER MATHEMATICS AND SCIENCE EDUCATION ACT: AN ANALYSIS OF RECENT LEGISLATIVE ACTION AND PROGRAM EVALUATIONS

INTRODUCTION

In 1984, the U.S. Congress authorized a program to address apparent nationwide problems in the availability of qualified individuals to teach mathematics and science at the elementary and secondary school level. 1/ The authority for the program, Title II of the Education for Economic Security Act (P.L. 98-377), was repealed in 1988 by the Augustus F. Hawkins-Robert T. Stafford Elementary and Secondary School Improvement Amendments of 1988 (P.L. 100-297). The program is now authorized by the Dwight D. Eisenhower Mathematics and Science Education Act (Part A, Title II, Elementary and Secondary Education, P.L. 89-10, as amended). 2/

Much of the present concern over young people's proficiency in math and science springs from a belief that such proficiency is important to improving the Nation's economic status. 3/ Although elementary and secondary school

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1/ See, Math/Science Education Program Authorized Under Title II of the Education for Economic Security Act (P.L. 98-377), in Federal Assistance for Elementary and Secondary Education: Background Information on Selected Programs Likely to be Considered for Reauthorization by the 100th Congress, Committee Print prepared for the Subcommittee on Elementary, Secondary, and Vocational Education of the House Committee on Education and Labor, Feb. 1987.

2/ The new version of the program is essentially an extension of the previous one, with some modifications. These modifications are described later in this report.

3/ See, for example, Business Week, Needed: Human Capital, special report, Sept. 19, 1988.

students appear to have made headway in improving their math and science skills during the mid 1980's, performance levels have, at best, only recovered to those of the early 1970's. 4/ Improvement appears to have been concentrated in basic skills, not in more complex or higher order skills. 5/ Despite a narrowing of the achievement gap that separates white students from their black and Hispanic counterparts, minority students at the high school level still score significantly below whites. Recent comparisons of math and science performance among students from different countries show U.S. students being outperformed almost consistently. 6/

The issue of perhaps greatest importance to the congressional authors of this effort involving math and science education was the availability of qualified math and science teachers for elementary and secondary education. 7/

4/ Educational Testing Service, The Science Report Card: Elements of Risk and Recovery, Trends and Achievement Based on the 1986 National Assessment, Sept. 1988; Educational Testing Service, The Mathematics Report Card: Are We Measuring Up? Trends and Achievement Based on the 1986 National Assessment, June 1988. For a broad overview, see U.S. Library of Congress. Congressional Research Service. Science, Engineering, and Mathematics Precollege and College Education. Issue Brief IB88086, by Christine Matthews Rose. Washington, Sept. 30, 1988, updated regularly.

5/ Mastery of basic skills is often thought of as involving mastery of facts and elementary procedures. For example, in mathematics, the basic skills have been defined as including abilities such as adding, subtracting, multiplying, and dividing one- or two-digit numbers. In contrast, higher order skills are described as requiring more complex capabilities, such as making judgments and interpreting data. In math, higher order skills entail such skills as solving problems with multiple steps and working with variables. (The Mathematics Report Card, figure 2.1, p. 31.)

6/ U.S. Library of Congress. Congressional Research Service. Comparison of the Achievement of American Elementary and Secondary Pupils With Those Abroad--Sponsored by the International Association for the Evaluation of Educational Achievement (IEA). CRS Report No. 86-683 EPW, by Wayne Riddle. Washington, updated June 30, 1984; U.S. Department of Education. National Center for Education Statistics. Digest of Education Statistics 1988. p. 335 and tables 289, 290.

7/ See, for example, U.S. House. Congress. Committee on Education and Labor. School Improvement Act of 1987. Report 100-95, 100th Congress, 1st Sess. Washington, U.S. Govt. Print.Off., May 15, 1987. p. 60-61.

Recent data suggest that problems may continue to exist. For example, a survey of math and science education for the school year 1985-86 found that a majority of high school principals reported difficulty in employing "fully qualified" physics, chemistry, computer science, math, and foreign language teachers. 8/ In that year, not all high school students had access to a full complement of science and mathematics courses. 9/ The National Science Teachers Association asserted that, in 1985-86, nearly a third of the Nation's high school students were enrolled in a math or science course taught by a math or science teacher not qualified to teach that particular course. 10/

This report provides a detailed explanation of the provisions of the new version of the math and science education program, a review of funding trends for it and Title II of the Education for Economic Security Act, and an analysis of available evaluations of the original version.

8/ Weiss, Iris R. Report of the 1985-86 National Survey of Science and Mathematics Education, Research Triangle Institute. Prepared for the National Science Foundation. Nov. 1987. The term "fully qualified" was not defined in the survey and so, apparently, its definition varied from respondent to respondent. In recent years, awareness of the difficulty in calculating teacher shortages in general, or in specific fields, has grown. At present, it would appear that available data are inadequate to the task. See, for example, Olson, Lynn, and Blake Rodman. Is There a Teacher Shortage? It's Anyone's Guess. Education Week, June 24, 1987.

9/ Weiss, Table 4. Although nearly all high schools in this country offered biology, approximately 19 percent had no first-year course in physics and 9 percent had no first-year chemistry. In mathematics, algebra I and geometry were nearly universal, but 41 percent of the high schools provided no instruction in trigonometry and 24 percent lacked calculus or other advanced mathematics courses. These figures may exaggerate the extent to which students do not have access to math and science courses. A recent study concluded that the smallest schools were least likely to offer physics and that 96 percent of all high school students had access to a first-year physics course. (Michael Neuschatz and Maude Covalt, Physics in the High School: Findings from the 1986-87 Nationwide Survey of Secondary School Teachers of Physics, American Institute of Physics, June 2, 1988).

10/ Lee, LeRoy R., President. National Science Teachers Association. Testimony before the House Subcommittee on Elementary, Secondary, and Vocational Education, of the Committee on Education and Labor. The Reauthorization of Expiring Federal Elementary and Secondary Education Programs, Miscellaneous Programs, v. 8, Serial no. 100-9, Apr. 2, 1987. p. 48.

MAJOR COMPONENTS OF THE EISENHOWER MATHEMATICS AND SCIENCE EDUCATION PROGRAM

This section provides a detailed look at the provisions of the Eisenhower Math and Science Education program following enactment in P.L. 100-297. 11/ The primary differences between the program as currently authorized and as previously authorized include:

1) with limited exceptions, activities involving computer education and foreign language instruction are no longer authorized for funding;

2) a greater percentage of program funds is now directed to local educational agencies with a more precise delineation of their eligible activities;

3) the percentage of program funds provided to the Secretary of Education for discretionary activities is substantially reduced; and

4) the Secretary of Education is newly required to submit a summary of State and local program evaluations biennially to the Congress.

The major components of the Eisenhower program are delineated below.

Purpose

The program is intended to enhance the abilities of teachers and the quality of math and science instruction in elementary and secondary schools, and, thereby, to improve the Nation's economic position and its security.

11/ It should be noted that Title II of the Education for Economic Security Act was amended by the Omnibus Trade Act, P.L. 100-418, to reduce its FY 1988 authorization level. This legislation was enacted after P.L. 100-297 had already repealed Title II.

Authorization of Appropriations

The legislation authorizes an appropriation of $250 million for FY 1989 and such sums as necessary for the period FY 1990 through FY 1993.

Interstate Allocation of Funds

From the annual appropriation, the Secretary of Education reserves up to .5 percent for the outlying areas; .5 percent for Indian students in schools funded by the Department of the Interior; and 4 percent for national programs (described below). The Secretary distributes the remainder, that is, at least 95 percent of the annual appropriation, to the States (including the District of Columbia and Puerto Rico). The table below shows the distribution of funds. (The FY 1989 appropriation act modified this distribution, see table 3. below).

TABLE 1. Allocation of Annual Appropriation at National Level

Recipient	Percentage of annual appropriation
Outlying areas	Up to .5%
Indian students	.5
National programs (Secretary of Education)	4.0
States	at least 95.0

Half of the amount allocated to the States is distributed on the basis of each State's share of total population aged 5 to 17; the other half is

distributed on the basis of each State's share of compensatory education allocations. 12/

The legislation provides that no State is to receive less than .5 percent of the amount allocated among the States or less than the amount it received for FY 1988 under the math and science education program.

Intrastate Allocation of Funds

Each State's allocation of funds is divided between elementary/secondary education activities, and higher education activities--75 percent of the allocation for the former; 25 percent for the latter.

Of the elementary and secondary education funds, at least 90 percent is distributed to local educational agencies. Half of those funds is distributed according to public and private school enrollments in individual districts. Half is allocated on the basis of low-income children (aged 5 to 17 years) in the districts' schools. 13/ The remaining 10 percent is used by the State educational agency for demonstration and exemplary programs, technical assistance, administrative costs, and program assessment. These activities are described in more detail below.

12/ Federal assistance for educationally disadvantaged children (compensatory education) was authorized under prior law by Chapter 1 of the Education Consolidation and Improvement Act of 1981, and is currently authorized by Title I of the Elementary and Secondary Education Act of 1965, as amended by P.L. 100-297. The allocations used as a basis for distributing math and science education funds are those applicable to whichever version of the compensatory education program was in effect in the previous fiscal year.

13/ These low-income children are the same as those counted for purposes of the Compensatory Education Program--children from families with income below the poverty level, and children whose family's payments under the Aid to Families with Dependent Children exceed the poverty level for a family of four.

At least 95 percent of a State's funds earmarked for higher education are to be awarded to institutions of higher education on a competitive basis. The remainder is to be used by the State higher education agency for assessment, administration, and evaluation.

The intrastate allocation of funds is depicted in table 2. below.

TABLE 2. Allocation of Annual Appropriation Within States*

Recipient	Percentage of State allocation
Elementary and secondary activities	75% (90% to local educational agencies; 10% to State educational agency)
Higher education activities	25% (95% to institutions of higher education; 5% to State higher education agency)

* Under the authorizing statute up to 95 percent of the annual appropriation is allocated to the States for the intrastate allocation.

Elementary and Secondary Education Programs

Local educational agencies must use their math and science funds for the following activities:

1) improvement of teacher training, including preservice and inservice training, and retraining in math and science; 14/

2) recruitment and retraining of minorities to be math and science teachers;

14/ Vocational education teachers who use math and science in their curriculum and other appropriate school personnel are explicitly included as eligible to receive services under this program.

3) training in the use of technology within a math and science program; 15/

4) integrating higher order thinking skills in the math and science curriculum; and

5) projects by individual teachers to improve their math and science instruction or improve instructional materials.

The training and instruction authorized can be provided through agreements between the local educational agencies and other public agencies, industry, higher education, museums, libraries, professional associations, etc. Activities in all five areas must reflect the need for improving the participation in math and science of specifically underrepresented groups, such as females, minorities, those with limited-English proficiency, the handicapped, migrants, and, particularly, the gifted and talented. Local educational agencies may apply for funding as part of a consortium involving local educational agencies and institutions of higher education.

Not more than 5 percent of any district's funding can be used to meet its administrative costs.

Each State educational agency is to use at least 5 percent of the State's elementary and secondary funding for demonstration and exemplary programs. The agency is to support programs for teacher training, instructional equipment and materials, underserved and underrepresented populations and the gifted, 16/ or disseminating information on exemplary programs. Projects for the underrepresented and underserved, and for the gifted, are to receive special consideration from the State agency. With up to 5 percent of the elementary and secondary funding, the State educational agency is to provide technical

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15/ Schools with an enrollment that is 50 percent or more low-income can use these funds to purchase computers and telecommunications equipment if their training needs have been met.

16/ Programs for the gifted may support magnet schools for such students.

assistance to local educational agencies, higher education institutions and other entities, and to meet the costs of administration and program assessment.

Higher Education Programs

State higher education agencies administer 25 percent of each State grant, allocating at least 95 percent to higher education institutions that show involvement with local educational agencies. These funds must be used for the following activities:

1) traineeship programs for new math and science teachers at the secondary school level;

2) retraining efforts in math and science for secondary school teachers in other disciplines; 17/

3) inservice training for elementary, secondary, and vocational education teachers to improve their skills in teaching math and science. 18/

Any higher education institution receiving these funds is to provide assurances that its training, retraining, and inservice programs reflect the needs of the underrepresented and underserved, and the gifted. The institution, in addition, must assure that it has cooperative arrangements with local educational agencies. If it is receiving funds for retraining or inservice training, the higher education institution must have an agreement with a local educational agency or a consortium of agencies to provide such services to the public and private school teachers in those agencies.

17/ The statute authorizes the payment of stipends for such individuals for participation in training institutes by the National Science Foundation.

18/ Other school personnel can receive training, if appropriate. The statute authorizes the payment of stipends for such individuals for participation in training institutes by the National Science Foundation.

In addition, the State higher education agency can award funds to cooperative programs involving higher education institutions, State and local educational agencies, industry, museums, professional associations, etc., for developing and disseminating projects to improve students' math and science achievement. 19/

The State higher education agency can spend up to 5 percent of the higher education allotment for a State assessment of teacher and curricular needs in math and science, for administration, and for evaluation.

State and Local Applications

Each State files an application with the Secretary of Education that covers a 3 year period. In its application, a State must assure that, among other activities, it will:

1) evaluate its standards for preparing, certifying, licensing, and endorsing math and science teachers;

2) recognize the needs of underserved and underrepresented populations in math and science;

3) use its math and science funds particularly to meet needs where low-income students are highly concentrated or where population is sparse; and

4) assess these programs and provide data to the Secretary of Education, as well as a summary of assessment performed by local educational agencies.

A State application must provide a projection of the supply and demand for math and science teachers, and an assessment of math and science curriculum needs. In addition, an application must describe the various activities that will be undertaken with the math and science funds.

19/ Funds for these cooperative arrangements come from the 95 percent reserved for higher education institutions.

A local educational agency is to submit an application for a 3-year period to its State educational agency. Such an application must assess the district's demand for math and science teachers, whether a shortage of math and science teachers currently exists or will within a 5-year period, the current status of math and science achievement, and the district's curricular needs in these fields. Among the other aspects of the district's program that must be described, if relevant, are the community resources that will be utilized. In addition, the application must provide assurances that the needs of underrepresented and underserved populations will be served, and that the supported program will be assessed.

National Programs

The Secretary of Education must use the 4 percent set-aside for national programs to make grants to, or enter into cooperative agreements with, State and local educational agencies, higher education institutions, museums, professional associations, etc. The Secretary gives special consideration to those entities providing special services in math and science to underserved and underrepresented populations, including particularly the gifted within such populations. In addition, the Secretary gives special consideration to programs that train or retrain teachers in scientific inquiry and that provide educational materials. The Secretary is to disseminate information about these grants and agreements, including information about exemplary programs in math and science instruction, and technical assistance for establishing such programs. (The FY 1989 appropriations act, in effect, raised the share of the FY 1989 appropriation to be used for National Programs to approximately 6.5 percent. See table 3. below).

Federal Requirements

The Secretary of Education is required to provide technical assistance and to develop procedures for State and local evaluations. Those procedures are to be developed in consultation with State and local officials. Also, in consultation with State and local agencies, and math and science educators, the Secretary develops model reporting standards for the data required in the State and local applications. Finally, the Secretary provides a biennial summary of State evaluations to the Congress.

Private School Students and Teachers

Private school students and teachers are to benefit from the activities funded under this legislation. Consistent with the number of students enrolled in private schools, the participation of students and teachers is to be equitable. If a State or local educational agency is unable or unwilling to provide for the participation of private school students and teachers, the Secretary of Education arranges for the provision of these services.

FUNDING TRENDS

This section reviews funding trends for the math and science education program, as previously authorized under Title II of the Education for Economic Security Act and as newly authorized under the Eisenhower Act.

Between FY 1985 and FY 1989, math and science funding fell and rose substantially. The initial appropriation level of $100 million was reduced by more than 50 percent the following year. A small part of that reduction was required sequestration under provisions of the Balanced Budget and Emergency Deficit Control Act of 1985 (P.L. 99-177). In more recent years, the Congress

has provided significant annual increases in funding. As a result, the FY 1989 level is more than three times as large as the FY 1986 level. Table 3 below provides the budget requests and appropriations from the inception of a math and science education program in FY 1985 to the present.

TABLE 3. Annual Funding for the Dwight D. Eisenhower Mathematics and Science Education Act, FY 1985-FY 1989

Fiscal year	Budget request	Appropriation
1985	$50,000,000*	$100,000,000
1986	100,000,000	43,066,000
1987	75,000,000**	80,000,000
1988	80,000,000**	119,675,000
1989	119,675,000	137,332,000***

* The FY 1985 and FY 1984 budgets requested $50 million for a math and science initiative being proposed by the Administration. This initiative was described in budget documents as a program to increase the number of persons able to teach secondary school math and science.

** The FY 1987 and FY 1988 budgets each proposed a new teaching initiative to replace the math and science program and other related programs. Although the proposal varied from one year to the next, in general it would have provided assistance for, among other things, inservice training of teachers and administrators in a broad array of subject areas, activities to recognize excellence, and efforts to attract people from other professions into teaching.

*** The FY 1989 appropriation act (P.L. 100-436) provides that $8.892 million of the annual appropriation must be spent on National Programs. This, in effect, raises the National Programs' share of the annual appropriation from the authorizing statute's 4.0 percent to approximately 6.5 percent. The conference report for the appropriation act (House Report 100-880) also stipulates that the Secretary of Education is to spend at least $5 million of that money for secondary schools with programs of national significance in science and mathematics.

NOTE: This table covers the math and science education program as previously authorized by Title II of the Education for Economic Security Act and as newly authorized by the Dwight D. Eisenhower Mathematics and Science Education Act (Title II of the Elementary and Secondary Education Act).

PROGRAM EVALUATIONS

Relatively little is known about the uses of funds from the Department of Education's math and science education program, and still less about the program's impact on students and teachers. This section provides a brief overview of the available data describing initial program implementation and the States' assessments of their math, science, foreign language, and computer learning needs, required under the program. 20/

Data from the first year of the program show that a substantial portion of the school districts in the country received small grants--approximately 37 percent received grants of less than $500. 21/ As a result, many districts apparently chose not to participate in the program in this initial year. For example, some 31 percent of California's districts declined to participate. 22/

Reportedly, most of the funds in that first year were used for inservice training and workshops to improve the skills of current math and science teachers. The program infrequently addressed some of its other objectives, such as retraining personnel to teach math and science or developing alternative certification processes. In some States, the Federal funds helped

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20/ The information provided in this section is derived primarily from two studies for which the Department of Education contracted--Dickens, Royce, et al. State Needs Assessment, Title II EESA: A Summary Report. DRC, Aug. 1987; and Marks, Ellen L. Title II of the Education for Economic Security Act: An Analysis of First-Year Operations. Policy Studies Associates, Oct. 1986.

21/ Marks, Title II, table 3, p. 7.

22/ Marks, Title II, p. 11. This study by Ellen Marks of Policy Studies Associates was based on telephone interviews with the Title II coordinators in nine States--California, Louisiana, Maine, Maryland, New Jersey, New York, South Carolina, Texas, and Vermont. Its findings do not necessarily describe the program as it operated in other States. Nevertheless, it is likely that they are applicable to a large extent.

districts adjust to newly imposed State requirements affecting math and science instruction.

States were required initially under the authorizing statute to provide the Secretary of Education with an assessment of the status of instruction in math, science, foreign language, and computer learning in their schools. An analysis of those State assessments suggested that the primary needs in the States were at the elementary school level where teachers needed to acquire basic science knowledge and instructional skills in math, and lacked necessary materials and equipment to teach science. 23/ Substantial needs were also identified for computer learning and foreign language training. This study also found that States were focusing their attention on improving teachers' skills, not on augmenting the math and science curriculum.

Finally, the Department of Education has recently contracted for a comprehensive study of the math and science program to be completed by 1991. This study is designed to provide extensive data on the uses of funds and their effect on such things as teacher qualifications, the quality of math and science curricula, and the access of underrepresented populations to these disciplines. It will gather information on the types of inservice and retraining activities being undertaken, the cooperative programs established by institutions of higher education, and the number and kinds of teachers receiving services.

23/ The study by Royce Dickens, et. al, of DRC, found that the State assessments were not submitted to the U.S. Department of Education in a consistent format and varied significantly in terms of the quality and extensiveness of data provided.